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ABSTRACT

The use of educational technology in rural schools can maximize the natural advantages of rural schools and alleviate the disadvantages. Rural schools often face geographic isolation, shortages in specialized staff, low student enrollments, small numbers of special needs students, limited program offerings for students, and limited opportunities for staff development for teachers and administrators. In 1992, the National Congress on Rural Education identified barriers to the improvement of rural education in the areas of funding, provision for special circumstances of rural education, staff development, adequate and qualified teaching personnel, administrator work overload, and remedial education. Technology can overcome or alleviate these barriers. Technology available for rural schools includes personal computers and software, and distance learning and telecommunication technologies, such as audiographics, two-way interactive television, electronic mail, electronic bulletin boards, online databases, and information networks. Library technologies offer specialized CD-ROM discs for reference services and telecommunications networks for online library searches. Technology use in rural schools should be evaluated in terms of whether or not it serves the purpose for which it is employed and what data supports the evaluation. To make successful improvements, rural school leaders must establish a climate of trust and openness, evaluate and screen the various possibilities for improvement, and provide administrative and financial support for the change effort. (KS)

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FASTBACK

ED 369 586

Technology in Rural Education

Weldon Beckner
Bruce O. Barker

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Technology in Rural Education

by
Weldon Beckner
and
Bruce O. Barker

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Introduction

Many of the problems in rural education result from trying to make small schools more like large schools, instead of making good use of the advantages inherent in smaller schools. For example, many small rural schools were consolidated into larger ones on the assumption that becoming more like urban schools would make them better.

Other problems in rural schools result from the limitations and disadvantages that are part of rural environments. These problems include the large areas that rural districts encompass, low levels of family income in many rural areas, and a general lack of financial resources in rural districts.

The effective use of modern technology can help to alleviate some of these problems and can maximize the natural advantages of rural life and smaller schools. Technology will not solve all these problems, but significant strides may be made in the right direction. For example, technology can help teachers get out of the "rut" of traditional thinking and perhaps lead them to think of innovations that can make teaching more effective.

Vaughan and her colleagues (1989) argue that technology in rural education can overcome three major problems: 1) rural isolation, 2) financial limitations related to small populations with low incomes, and 3) the need for specialized courses for small numbers of students. In addition, technology can help rural schools to improve achievement, to offer additional courses, to enhance student self-esteem, to

offer staff-development programs, and to promote community involvement.

However, Vaughan and her colleagues point out that technology may be both a "godsend" and a "nightmare" for rural schools. While technology may be a way to overcome many problems, other problems may be posed by the costs and logistics of obtaining hardware and software and by the challenge to develop the expertise needed for their effective use.

The technology used in rural schools may range from simple computer-assisted curriculum and instruction to interactive instruction via satellite, telephone, or networked computers. Such technologies as fiber optics, microwave, cable, slow-scan TV, or Instructional Television Fixed Service (ITFS) also may be integrated into combinations that are tailored to meet many individual needs. Less-complicated, inexpensive technologies, such as videotape, may be used for a number of teaching activities in schools and communities.

To explore why and how modern technology can be used to improve education in rural areas, we will begin with a brief overview of the major aspects of rural education. This will be followed by a more detailed discussion of the most useful educational technologies, how they are being used, their potential benefits and disadvantages, and cost considerations.

Rural Education Today

There is something inherently different about most small schools, particularly those located in rural communities. There is an element of "family" or "community" not common in larger schools nor in urban settings. Beckner observed 10 years ago that:

> the traditional small school was an extension of its community. Indeed, it was difficult to determine just where education ended and community life began around the school. The school was a community responsibility; the community was a school responsibility. (1983, p. 9)

Some of this "community" feeling may have been lost, but most rural citizens would argue that it is still one of the major features they value about "country life."

Rural schools tend to be poorer than those in other districts, with lower average per capita income, higher poverty levels, and a narrower tax base. They provide lower salaries for both teachers and administrators than larger districts provide. And they have lower percentages of minority students and staff. They also have lower dropout rates and lower pupil-teacher ratios than do larger districts (Vaughan et al. 1989).

Most of the changes in rural education during the past 50 or 60 years have been quantitative in nature, such as consolidating schools to provide larger organizational units, training teachers more extensively, providing more instructional resources, offering more courses,

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and asking rural schools to take on additional responsibilities (Nachtigal 1980-81). However, schooling itself has not changed very much – one teacher in a classroom with 25 or 30 students of similar age, using one or more textbooks, and lecturing or using other teacher-centered methods of instruction. Specialization, centralization of decision making, and the concept that bigger is better have dominated more recent developments.

The rural school is important to the future development of rural communities, both in terms of economics and the quality of rural life. In either case, modern technology must occupy a place of importance in rural schools. Technology can increase the effectiveness of the traditional models of education currently used in rural schools, and it can help overcome some of the inadequacies endemic to the rural school by providing creative ways for students to learn.

Traditionally, teachers were needed as experts in the subject matter and to organize subject matter for transmission of knowledge. Things are different now. As Swanson (1988) explained:

> In an information-rich society, the teacher as a source of information is rapidly becoming obsolete. Libraries, textbooks, television, videodisks, computers and computer software, and information retrieval systems provide the means whereby any student, once s/he learns how to read and to use these resources, can retrieve most information needed.

Individualized instruction and continuous progress in learning, two concepts widely accepted by educators today, are enhanced by technology.

The use of technology in rural schools has not been well documented, but growth in the overall use of computers in the United States indicates the importance of this change in our education system. According to the *Digest of Education Statistics* (1992), about 36% of all American workers used computers on their jobs in October 1989. While only 18% of the public schools used microcomputers in 1981,

by 1990 this number had grown to 97%. The numbers of students using computers grew from 27.3% in 1984 to 42.7% in 1989. Other technologies used in schools have not increased at such a rapid pace, but their growth rates are also significant.

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Identifying the Needs of Rural Schools

The most extensive recent effort to identify needs in rural education was carried out by the National Rural Education Association at the National Congress on Rural Education on 11 October 1992. Invitations were extended to selected individuals throughout the country to participate in the congress and to help set directions and priorities for efforts to improve rural education. Attended by 458 education and civic leaders representing almost all of the United States and its territories, the congress reached consensus on major questions dealing with "the most disabling and chronic barriers to the improvement of rural education in America" and "the solutions and strategies for addressing the barriers" (Gregory 1992).

The congress identified a number of barriers and recommended solutions and strategies. Several related to the use of technology, including:

1. Adequate funding.
2. Provision for special circumstances of rural education.
3. Staff development.
4. Adequate and qualified teaching personnel.
5. Administrator work overload.
6. Remedial education.

A brief review of rural education needs identified by the National Congress on Rural Education suggests a variety of ways in which tech-

nology, especially computers and information-access technology, may be used to help meet those needs. A few examples will suggest a much wider variety of possibilities.

Adequate Funding. Although the expense of acquiring hardware and software will require substantial investment, their long-term use may produce a variety of cost savings, primarily through reductions in teaching and staff personnel. Distance-learning technology may allow sharing of teaching personnel by two or more districts, and increased efficiency and speed of work may allow reductions in clerical and secretarial staff. Other monetary savings may result from increased efficiency in budgeting and purchasing of goods and services.

Provision for Special Circumstances of Rural Education. Most of these "special circumstances" have to do with the competencies of teaching personnel, access to instructional equipment, information and materials, and adequate funding. Various uses of technology provide opportunities for alleviating these needs.

Staff Development. The most important needs relative to staff development have to do with teaching skills and providing materials for teaching and learning. Teachers will become more effective as they make more use of computers and other forms of technology to access information for instruction and to improve their teaching.

Adequate and Qualified Teaching Personnel. Offering and effectively teaching the variety of learning experiences that students need is one of the most difficult challenges for rural schools. Meeting individual student needs at the elementary school level and offering a variety of subjects at the secondary school level require specialized preparation and specialized skills not available to rural schools without great expense, unless good use is made of modern technology.

Sharing teacher expertise through cooperative distance learning and enhancing classroom opportunities through computer-assisted instruction can greatly improve student learning. An example of this was found in a study by Griswold (1985-86) that concluded: "Computers

can make traditional instruction more efficient and effective. CAI as a supplement to classroom teaching increases student achievement, reduces learning time, and establishes positive feelings toward computers and toward school work. CAI is more effective with lower ability, disadvantaged, or non-traditional learners."

To take advantage of the opportunities available through technology means that teachers must be prepared to accept a new role. They must be leaders of problem-solving activities by students, in addition to being organizers and disseminators of data. It also requires that coordination and scheduling be worked out among schools or school districts involved in cooperative distance learning.

Administrator Work Overload. The rapidly expanding tasks of school administration are recognized as a serious concern for rural schools. The rural school administrator is responsible for the same range of supervisory and administrative tasks (including most of the same reports to various agencies) as the urban school administrator, but with much less help. Fortunately, computer technology offers a multitude of programs to help the rural administrator with these tasks. The major deterrent to making use of these programs is simply the time and money required to acquire and learn to use them.

Remedial Education. This topic has been addressed above in discussion of those needs related to providing adequate curriculum and instruction. It is in working with those students who need remedial education that technology often can be most effective.

Effective use of instructional and administrative technology is the most promising development in recent years to meet the special needs of rural education. Other efforts, such as school consolidation and supplementary funding, have been very limited in their effectiveness. The prospects for the future use of technology are the new hope in rural education.

Available Technology for Rural Schools

We do not have precise data on what educational technologies are available in the nation's rural schools and how they are being used. We can conjecture about the availability of technology in rural schools by remembering that large and medium-size districts are usually further along in adoption of technologies than the average small or rural district. This generalization tends to apply across technologies, from computers to CD-ROM to video. Nevertheless, anecdotal information from educational conferences and printed proceedings indicates that many rural schools are making extensive use of distance learning and telecommunications technologies.

The latest survey from Quality Education Data (QED), a private organization in Denver, Colorado, reported technology trends for large and medium-size school districts for the 1992-93 school year (*Update* 1993). QED reported, for example, that the computer hardware currently in the schools was approximately 48% Apple IIe machines, 17% Macintosh machines, 30% MS-DOS machines, and 5% other types of computers. These findings support the contention that almost one-half of all schools are still equipped with mid-1980s computers. Purchase plans for new computers for 1993-94 were reported at 5% Apple IIe, 43% Macintosh, 51% MS-DOS computers, and 1% other computers. Clearly, the trend is to discontinue the old Apple IIe machines and to upgrade to more current Macintosh and MS-DOS units.

The survey indicated that schools planned to purchase computer software for all areas of the curriculum; however, mathematics programs had an edge over language arts, science, reading, social studies, and business applications. The ratio of instructional software to hardware spending in the schools was 30% – that is, for every dollar spent on hardware, 30¢ was spent on software.

To presume that all, or even most, rural schools are on the "cutting edge" in using today's innovative technologies would be a gross exaggeration. The actual application of computer, video, and telecommunications technologies in education in general and rural schools in particular is far beneath its potential.

Distance Learning and Telecommunications Technologies

Today's students – whether they live in rural or metropolitan areas – are growing up in the electronic age. They are getting much of their information from television, computers, video games, and other electronic devices. Rapid technological developments of the past decade have made possible an array of tools that can profoundly change today's classrooms. Schools in the mid-1980s were fortunate if they were able to provide several computers for student use, as well as teacher access to videocassette recorders (VCRs). But if schools today are to be on the "cutting edge" of technology, then they also need access to satellite links, telecommunications networks, electronic databases, and multimedia.

These advancing technologies have the potential to change the way students learn and the manner in which teachers teach. This is especially true of developments in distance learning and telecommunications – particularly satellite downlinking, fiber optics, digital transmissions, electronic bulletin boards (EBBs), distant databases, facsimile machines (FAX), video telephones, and so on. These technologies seem to have the greatest potential for helping rural schools overcome the disadvantages of geographic isolation, where shortages in specialized staff, low student enrollments, and small numbers of

special needs students limit program offerings for students and staff-development opportunities for teachers and administrators.

Telecommunicated distance learning is the delivery of real-time, live instruction from a distant site to one or more receiving sites using audio or video technologies that allow the teacher and students at all the different sites to interact with each other. Distance learning in the United States received an impetus when the U.S. Congress passed Public Law 100-297 in late 1988, allocating $100 million to create the federal Star Schools Program in support of distance learning efforts to benefit education (Withrow 1990).

Rural schools have been avid users of distance-learning programs in order to meet state-mandated curriculum requirements, to offer required courses for which a certified teacher is not available, or to provide inservice training in remote locations. Distance-learning programs of one type or another now operate in all 50 states. Analog signal over satellite, microwave, slow-scan TV, and computer audiographics are the most common technologies currently in use in distance-education programs (Barker 1992). However, rapid developments in compressed video technologies, using copper telephone lines and fiber optics, are receiving increased attention by distance-education experts. Following are some of the numerous applications of distance learning:

Electronic Field Trips. Under the direction of a teacher, students use video telephones and facsimile machines to see and talk to students or nationally known experts in other parts of the country, and in other countries, and to share print and graphic materials. Electronic field trips have been used by rural schools in New York, Hawaii, Illinois, North Carolina, and other states.

Audiographics. Audiographic teleteaching is a computer-network, distance-learning system that incorporates computer-generated graphics. The graphics function much like an electronic chalkboard. Audiographics require specially designed telecommunications software that allows the user to create computer graphics and multi-sized text, called

"slides," which can be transmitted in real time from one computer to another over regular telephone lines.

The networked computers operate on a "common screen" basis. That is, the slide shown on the host computer automatically appears on the computer monitors at distant sites. Audio interaction between the host and distant sites is through a speaker telephone. Use of facsimile machines permits hard copy exchange of instructional handouts or student written work. Successful audiographic programs serving rural schools have been operated in Pennsylvania, Texas, Utah, New York, Alabama, Hawaii, South Dakota, Louisiana, and South Carolina (Neights 1993).

Interactive Satellite TV Programs. Satellite-delivered distance education has been the most widely accepted distance-learning medium among rural schools. Live TV broadcasts are beamed from a host-site classroom or studio through an up-link dish to a satellite transponder. The signal is then beamed back to down-link dishes at the various receiver sites. A single satellite's "footprint" can cover one-third of the earth, thereby permitting simultaneous transmission across the entire United States and most of Canada and Mexico. In this configuration, satellite technology permits one-way transmission of voice, data, and full-motion video.

Audio talk-back by participants at the receiver sites can be achieved over regular telephone lines. By using the telephone at receiver sites, students can call in questions and hear their instructor's response on the air. But they are unable to see or talk directly with students located at different sites without routing their calls through the host site. Likewise, the teacher cannot see students but is able to respond to questions or comments whenever students call in on the telephone line.

Most distance-learning satellite systems also can send hard-copy handouts and exams over the satellite directly to the receiver sites. In most of the satellite networks now in operation, a classroom facilitator – who may be a teacher's aid, a volunteer, or another teacher – sits in with the students to operate the equipment, distribute materi-

als, and otherwise provide assistance. Student homework assignments typically are routed through the U.S. Postal Service for the TV teacher's evaluation (Barker 1991).

Kentucky has established its own statewide network. Large networks also have been established in North Carolina, Illinois, Oklahoma, Washington, South Carolina, Missouri, and Texas. Noted program providers predominantly serving rural schools are the TI-IN Network in San Antonio, Texas; the Satellite Telecommunications Educational Programming network in Spokane, Washington; the Arts and Sciences Teleconferencing network in Stillwater, Oklahoma; and the Satellite Education Resources Consortium based in South Carolina.

Two-Way Interactive Television Systems. Most two-way TV systems are locally controlled cooperatives made up of three to six schools linked together in order to share human, financial, and equipment resources. Unlike the one-way video/two-way audio format common to satellite TV systems, in two-way interactive TV systems the teacher in one location and students in distant locations can both see and hear each other during instruction. Not only are students able to interact with their TV teacher, they also are able to see, hear, and communicate freely with their TV classmates at different schools.

Technologies for transmitting two-way TV signals include low-power television, microwave signal, fiber optics, coaxial cable, and digital compression. Among the first rural schools to report success in working with two-way interactive television systems were small networks in Minnesota, Illinois, Arizona, and Oklahoma (Barker 1989; Followill and Andersen 1991; Kitchen 1987; Robinson 1985). Interest and participation by rural schools in two-way interactive TV systems has grown rapidly in recent years, making it difficult to accurately document all those that are currently in the planning stages or actually in operation.

Telecommunications and Electronic Mail

Computer-based telecommunications can provide opportunities for teachers and students that simply are not possible through traditional

telephone or mail services. The two basic telecommunications services most often used by schools are access to large electronic databases and electronic bulletin boards and the opportunity for users to communicate by means of electronic mail (E-mail).

Databases and bulletin boards contain all sorts of information, far surpassing what can be found at the school or local library. And the information is much more readily available than using interlibrary loan. It has been estimated that more than 14,000 electronic databases are available to computer users in the United States (Thornburg 1992), with more than 5,000 available online (*Directory of Online Databases* 1993).

Through E-mail, teachers and students easily can converse "on line" with people they have never met but who share a common interest. For users with access to Internet, there exists the possibility of logging on to other computers around the world. In short, teachers and students can share ideas and access information and resources with a much broader community than would otherwise be imaginable.

Teachers and students skilled in telecommunications can extend learning far beyond the walls of the traditional classroom through the microcomputer, modem, and regular telephone lines. Furthermore, databases, bulletin boards, and E-mail messages may be accessed at the user's convenience, thus eliminating the constraints of time and distance.

Many networks are particularly suited to rural schools. Some of these are ERIC/CRESS Online, National Distance Learning Center Online, America Tomorrow Leadership Information Service, the American Indian Science and Engineering Society network, SpecialNet, CLASSMATE and Classroom Instruction Program sponsored by DIALOG Information Services, U.S. government-sponsored bulletin boards, and numerous statewide networks.

It should be understood that the databases, networks, and electronic bulletin boards discussed in this fastback do not include all that are available. It would be impossible to list them all in this fastback,

and any list would be obsolete soon after it was compiled. Telecommunications is a resource that is growing exponentially; new networks and new databases continually are opening to interested users. With that in mind, following are some descriptions of electronic resources that are particularly relevant for rural schools.

ERIC Services and ERIC/CRESS Online. The Educational Resources Information Center (ERIC) system, sponsored by the U.S. Department of Education, is the largest electronic database in the world. With a working knowledge of how to use ERIC, students and teachers can gather information on almost any topic in education. Thousands of documents, reports, conference proceedings, and articles have been collected and microfilmed and are easily accessible to interested users.

Currently, 16 ERIC clearinghouses collect, abstract, and put on microfiche 2,600 documents each month for distribution to nearly 3,000 repositories, mostly college and university libraries. Within the last five years, the ERIC index has been placed on CD-ROM and also is available on Internet. Previously, users had to travel to the nearest college or university to gain access to ERIC; but now, users can search the ERIC index online if they have a computer and modem.

In late 1993, the ERIC Clearinghouse on Rural Education and Small Schools (ERIC/CRESS) announced plans to create the ERIC/CRESS Online network. The service is intended to serve chiefly rural schools and will offer free service accessible from anywhere in the United States. Initial plans include the following services: 1) downloadable ERIC/CRESS publications, such as *ERIC Digests* and newsletter issues; 2) a database of organizations focusing on rural education, American Indian education, and outdoor education; 3) free, customized searches of the ERIC database by ERIC/CRESS staff members; and 4) online ordering of ERIC/CRESS printed publications. A toll-free number will allow anyone to make use of ERIC/CRESS services, provided they have a microcomputer and modem. Information on joining the ERIC/CRESS Online service can be obtained by contacting ERIC/CRESS, Appalachia Educational

Laboratory, P.O. Box 1348, Charleston, WV 25325, or calling (800) LET-ERIC (800-583-3742).

National Distance Learning Center Online (NDLC). NDLC provides online searches 24 hours a day free of charge. The database offers information on distance-learning programs and curriculum materials for K-12, higher education, continuing education, and general interest teleconferences. The NDLC database changes daily with the addition of new listings, new subject areas, and new providers. Through this database, teachers and students can investigate all sorts of materials, such as possible contacts for electronic field trips, videos, curriculum guides, and computer software to supplement or support traditional classroom instruction.

In order to access the resources of NDLC, schools need only a computer and a 2400-baud modem. No charge is assessed, but the schools pay for the long-distance call. Readers interested in more information should contact NDLC, Owensboro Community College, 4800 New Hartford Road, Owensboro, KY 42303; or call (502) 686-4556. The Internet address for this database is NDLC.OCC.UKY.EDU.

America Tomorrow Leadership Information Service (ATLIS). ATLIS is supported by America Tomorrow Inc., a Delaware corporation founded in August 1991. ATLIS is an online computer network linking school, business, and community leaders to provide opportunities for decision makers to discuss issues and concerns affecting schools in local communities.

In addition to E-mail services among members, this network provides school leaders with a source of condensed news and information that is updated daily from a large number of national education and business organizations, including the Association for Teacher Educators, the National Association of Elementary School Principals, the National Association of Secondary School Principals, the National Association of State Boards of Education, the National Board for Professional Teaching Standards, the National Community Education Association, the National Council of Teachers of Mathematics,

the National Education Goals Panel, the National Head Start Association, and the U.S. Department of Education.

Specific services of ATLIS include: 1) an electronic news service from participating organizations; 2) an information database containing calendar, resource, and information topics organized by association; 3) an issues-and-answers database dealing with the educational, health, and social issues and trends that affect learning; 4) a topically organized bulletin board that lets users initiate and participate in discussions on topics raised by ATLIS members; and 5) the opportunity for E-mail communication by ATLIS members across the network.

The annual membership fee to join the network is less than $200. Readers interested in more information should contact America Tomorrow Inc., P.O. Box 2310, Bethesda, MD 20827-2310 or call (800) 456-8881.

American Indian Science and Engineering Society Electronic Network (AISESnet). American Indians make up a large segment of the rural American population. AISESnet serves as an informal means for distributing information to AISES members, high school students, Indian reservations, and members of industry. To join AISESnet, users must have an Internet account. AISESnet users enjoy the benefits of E-mail and are able to access a database of AISES news and information, a calendar of events, chapter newsletters, and other services. Readers interested in more information should contact the Department of Native American Studies, 600 University Avenue, University of Montana, Missoula, MT 59812 or call (406) 243-5733.

SpecialNet. The services provided by SpecialNet are offered through GTE Educational Network Services. Every state office of education is a subscriber, as are many local education agencies in each of the 50 states. SpecialNet is a gateway to specialized databases, E-mail between subscribers, and electronic bulletin boards. Some of the databases accessible through SpecialNet deal with early childhood education, children with special needs and their families, individuals with disabilities, special education law, employment opportunities in edu-

cation, promising educational practices, and recruitment and retention of teachers.

There are a large number of SpecialNet bulletin boards that can be accessed by network subscribers. Each bulletin board is managed by subject matter experts. A sampling of bulletin boards in general education and human services includes topics such as AIDS, upcoming educational conferences, national statistics on education, litigation, computer applications, and software. Topical bulletin boards addressing special education issues include assistive devices, news from the Council of Administrators of Special Education, behavior disorders/emotional disturbance, news from the Council for Exceptional Children, early childhood education and children with special needs, learning disabled children, deaf education, and many more.

Educators interested in more information about SpecialNet services and subscription fees should contact GTE Educational Network Services at (800) 927-3000.

CLASSMATE and Classroom Instruction Program. Two separate electronic database resources offered by DIALOG Information Services are CLASSMATE and the Classroom Instruction Program (CIP). Both are designed for use by students in conducting research assigned by teachers. CLASSMATE is a menu-driven resource of 120 different databases intended for students in K-12. CIP is a more extensive resource comprised of some 350 separate databases intended for students in grades 9-12. There is no sign-up fee or annual subscription cost to use either CLASSMATE or CIP; however, users pay connect charges of 25¢ per minute or $15 per hour.

For more information about either CLASSMATE or CIP, contact DIALOG Information Services, 3460 Hillview Avenue, Palo Alto, CA 94304 or call (800) 334-2564.

Statewide Networks and State-Sponsored Bulletin Boards. Several states have established statewide telecommunications networks to serve their schools. Others are in the planning stages to establish such networks. For example, the Florida Information Resources Network

connects data centers and computer resources at universities, junior colleges, and public schools throughout Florida. E-mail also is provided for all network users. Teachers and students in schools throughout the state can retrieve information from remote databases, download teachers' guides, capture images of satellite weather maps, and participate via E-mail in "electronic conferences" of common interest (Barron and Ivers 1993).

Big Sky Telegraph, sponsored by Western Montana College, provides a similar service to teachers and students throughout Montana, including Montana's 114 remaining one-room schools. TENET in Texas and ILLINET in Illinois are other examples of statewide networks.

U.S. Government-Sponsored Electronic Bulletin Boards. More than 100 highly specialized bulletin boards are sponsored by the federal government (Nyberg 1993). Most are reached by long-distance toll calls, a few by toll-free 800 numbers, and some via Internet. Federally supported bulletin boards cover essentially the full range of government departments, from agriculture to veterans' affairs, and offer a continuously updated assortment of government information in the form of reports, statistics, software, and graphics.

The growth of telecommunications networks and bulletin boards in both private and public sectors is advancing so rapidly that it is virtually impossible to keep abreast of all the new ones as they become available. For this reason, readers of this fastback who are interested in learning more about specific telecommunications networks or electronic bulletin board services are encouraged to contact the technology department in their state office of education. Educational technology specialists at the state level should be knowledgeable about specific services and their potential for local use.

Internet as a Telecommunications Resource

The most widespread of all telecommunications networks is Internet. Internet is a "network of networks" located all over the world.

The total number of computers and users connected to Internet is estimated at between four million and five million (Descy 1993). At present, government agencies, colleges and universities, and the U.S. military are the major users of Internet. While K-12 connections to Internet are in their infancy, authorities anticipate that Internet connections among K-12 schools will proliferate dramatically in the near future (Howley 1992).

Future plans include expanding Internet services to K-12 schools and to public libraries, thereby creating a national network for research in education. The goal for connecting K-12 schools to Internet services seems very simple, but is quite impressive:

> Electronic connections will become as commonplace as telephone connections. Every school, every home, and every office will be wired electronically. The electronic infrastructure is being built now, and at some future time schools, homes, and businesses will be able to download text, still images, and audio and video products. . . . Internet service providers [will] reach the K-12 audience. Dramatic developments are likely in the 1990s. (Howley 1992, p. 2)

Internet is used for E-mail between individuals and groups, for remote log-on to other computers to search their databases, and for file transfer from one Internet computer to another. Those connected to Internet have free access to hundreds of library catalogues across the country and around the world. They also can participate in thousands of special-interest groups and download thousands of computer software programs and full-text documents. Readers are encouraged to contact their state office of education to learn about Internet developments for K-12 schools in their area.

Library Technologies for Rural Schools

Many libraries in rural schools have outdated and substandard collections. But there are two modern technologies that librarians in rural schools can use to alleviate this problem. Those technologies are specialized CD-ROM discs for reference services and telecommunications networks for online library searches.

The H.W. Wilson Company offers WILSONDISC and WILSEARCH services to school libraries. The WILSONDISC CD-ROM retrieval system consists of 19 specialized databases, each available on a separate compact disc. Database titles include *Readers' Guide to Periodical Literature*, *Readers' Guide Abstracts*, *Biography Index*, *Book Review Digest*, *Art Index*, *Education Index*, and *Humanities Index*. Most WILSONDISC databases are updated monthly, thereby providing users quick access to new information.

The WILSONDISC databases may be too expensive for a small rural school to justify, since each database is individually priced. A considerably less-expensive alternative is WILSEARCH, which allows the user with a computer and modem to search through any of the WILSONDISC databases. WILSEARCH costs are within the range of most rural school budgets. Instead of purchasing individual CD-ROM databases, schools pay a dollar per search to access the same resources. Schools also pay the cost of the long-distance call and a nominal purchase fee for WILSEARCH communications software.

Readers interested in learning more about WILSONDISC CD-ROM or WILSEARCH services should contact The H.W. Wilson Company, 950 University Avenue, Bronx, NY 10452 or call (800) 367-6770.

The Information Access Company provides three popular resources for libraries: InfoTrac's TOM™, Magazine Index/Select™, and Magazine Index/Plus™. Each is a CD-ROM that includes indices and abstracts of popular magazines. The services are updated monthly.

TOM™, designed chiefly for small school libraries, provides access to more than 140 magazines dating from 1980. Since 1985, full texts have been provided for 75% of the TOM™ collection. Magazine Index/Select™ is a similar service that indexes and abstracts more than 200 magazines, with full texts for more than 80 periodicals. Magazine Index/Plus™ indexes and abstracts 400 popular magazines with full texts provided for more than 300 titles.

Readers interested in learning more about these services should contact the Information Access Company, 362 Lakeside Drive, Foster City, CA 94404 or call (800) 227-8431.

Evaluating Technology Use in Rural Education

Technology use in rural schools should be evaluated in much the same way as one would evaluate any educational endeavor. Key questions are: Does the technology serve the purpose for which it is employed? What data support the evaluation?

Educators may find it particularly valuable to gather and analyze appropriate data about the technology's effects on student achievement. That evaluation does not have to be particularly complex; pre- and post-test data usually will give information that is sufficiently reliable. Other evaluation designs, such as questionnaires and interviews, also may be used effectively. Also, various kinds of qualitative research, such as case studies and "shadowing," may yield reliable information about the effect of technology use; but these techniques tend to be very time consuming. However, when evaluating the effect of technology on achievement, educators must make an allowance for variables other than the use of technology.

Because most rural school administrators and teachers are pressed for time, it is very difficult for them also to take time to adequately evaluate the effectiveness of technology in their schools. Therefore, it often is advisable to employ a consultant to guide the evaluation and to carry out some of the procedures. However, local involvement should be extensive, as it will provide better insight into the total evaluation and the results will be given greater credibility by the professional staff and the community.

Conclusion

The past 15 to 20 years have seen a significant change in our understanding of rural education. There is now a general recognition that the needs of rural education are significantly different from those of urban schools and that the practices that are best in one may not work well in the other. Rural schools have particular advantages and disadvantages that differ from schools in other areas. Modern technology provides an exciting and promising way to maximize the natural advantages and alleviate the disadvantages.

To bring about change in small school districts, those responsible for leadership must follow the best current knowledge about organizational change. Rural school leaders should pay particular attention to the three primary elements that are necessary for successful improvement: They first must establish a climate of trust and openness in the schools and in the community; they must evaluate and screen the various possibilities for improvement, including the technological options; and, most important, they must provide administrative and financial support for the change effort (Firestone 1980, p. 182).

In 1993, the Southern Regional Education Board posed a challenge for educators to make the best use of technology in schools:

> We are learning that educational technology can improve teaching and learning. . . . We have growing evidence that computer software programs, satellite feeds, electronic bulletin boards, interactive net-

works, and multimedia equipment can improve instruction. But few teachers and principals are well-trained in the use of such technology, and few colleges and universities use such technology in their own teacher preparation programs. Are we in a position that will make it possible to best take advantage of educational technology today and more advantage of the technology of tomorrow? (SREB 1993, p. 15)

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Phi Delta Kappa Educational Foundation

The Phi Delta Kappa Educational Foundation was established on 13 October 1966 with the signing, by Dr. George H. Reavis, of the irrevocable trust agreement creating the Phi Delta Kappa Educational Foundation Trust.

George H. Reavis (1883-1970) entered the education profession after graduating from Warrensburg Missouri State Teachers College in 1906 and the University of Missouri in 1911. He went on to earn an M.A. and a Ph.D. at Columbia University. Dr. Reavis served as assistant superintendent of schools in Maryland and dean of the College of Arts and Sciences and the School of Education at the University of Pittsburgh. In 1929 he was appointed director of instruction for the Ohio State Department of Education. But it was as assistant superintendent for curriculum and instruction in the Cincinnati public schools (1939-48) that he rose to national prominence.

Dr. Reavis' dream for the Educational Foundation was to make it possible for seasoned educators to write and publish the wisdom they had acquired over a lifetime of professional activity. He wanted educators and the general public to "better understand (1) the nature of the educative process and (2) the relation of education to human welfare."

The Phi Delta Kappa fastbacks were begun in 1972. These publications, along with monographs and books on a wide range of topics related to education, are the realization of that dream.

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